We claim:

1. A boiler comprising, in combination:

a burner subassembly having a fuel inlet, an oxidant inlet, a combustion chamber, a flue gas composition detector and a flue gas outlet, the fuel inlet constructed and arranged to provide fuel to the combustion chamber, the oxidant inlet constructed and arranged to provide an oxygen-containing inlet stream to the combustion chamber, the combustion chamber constructed and arranged to burn the fuel thereby producing heat and a flue gas having characteristics including CO composition, NO_X composition, O_2 composition, and temperature, the flue gas composition detector constructed and arranged to measure at least one characteristic of the flue gas and generate flue gas data, and the flue gas outlet constructed and arranged to exhaust the flue gas from the combustion chamber;

a steam subassembly having a supply water inlet, a heat exchange zone, a water drum, a steam quality actuator and a steam outlet, the supply water inlet constructed and arranged to provide feed water to the heat exchange zone, the heat exchange zone constructed and arranged to transfer at least a portion of the heat generated by combustion of the fuel to the water and generate steam having characteristics including steam temperature and steam pressure, the water drum constructed and arranged to receive the heated water and steam from the heat transfer zone and maintain water and steam in the drum at a selected steam pressure and water level, the steam outlet constructed and arranged to transfer steam from the water drum and transport it out of the steam subassembly, and the steam quality actuator constructed and arranged to regulate at least one characteristic of the steam;

the oxygen-containing inlet stream having an inlet stream actuator constructed and arranged to regulate the rate of oxygen being introduced into the combustion chamber;

the fuel inlet having a fuel inlet actuator constructed and arranged to regulate the rate of fuel being introduced into the combustion chamber;

a water drum condition monitor constructed and arranged to monitor the water level and at least one of the temperature and pressure in the water drum and generate water drum data;

a combustion controller having a flue gas data input, a water drum data input, a combustion control output and a steam control output;

the flue gas data input receiving the flue gas data, the water drum data input receiving the water drum data, the combustion controller comparing the data and selecting the combustion control output and the steam control output;

the combustion control output operatively associated with the inlet stream actuator, the fuel inlet actuator and the steam quality actuator to optimize combustion of the fuel.

2. The boiler of Claim 1, wherein the flue gas data comprises information regarding flue gas characteristics including at least one of O_2, NO_x, SO_x, H_2O, CO, CO_2 and T_{fg}.

3. The boiler of Claim 1, wherein the flue gas data comprises information regarding flue gas characteristics including at least one characteristic from which at least one of O_2, NO_x, SO_x, H_2O, CO, CO_2 and T_{fg} can be deduced.

4. The boiler of Claim 1, the oxidant inlet stream actuator being constructed and arranged to regulate the amount of oxygen flowrate by varying the oxygen content of the oxidant stream.

5. The boiler of Claim 1, the oxidant inlet stream actuator being constructed and arranged to regulate the amount of oxygen flowrate by varying the flowrate of oxidant in the oxidant stream.

6. The boiler of Claim 4, the oxidant inlet stream actuator being constructed and arranged to regulate the amount of oxygen flowrate by varying the flowrate of oxidant in the oxidant stream.

7. A boiler comprising, in combination:

a burner subassembly having a fuel inlet, a primary oxidant inlet, a secondary oxidant inlet, a combustion chamber, a flue gas composition detector and a flue gas outlet, the fuel inlet constructed and arranged to provide fuel to the combustion chamber, the primary oxidant inlet constructed and arranged to provide an oxygen-containing inlet stream to the combustion chamber at a location near the fuel inlet so that the oxidant and the fuel are substantially mixed before or immediately upon entering the combustion chamber, thereby

defining a first combustion zone, the secondary oxidant inlet constructed and arranged to provide a secondary oxygen-containing inlet stream to the combustion chamber at a location sufficiently removed from the fuel inlet to define a second combustion zone, the combustion chamber constructed and arranged to burn the fuel thereby producing heat and a flue gas having characteristics including CO composition, NO_X composition, O_2 composition, and temperature, the flue gas composition detector constructed and arranged to measure at least one characteristic of the flue gas and generate flue gas data, and the flue gas outlet constructed and arranged to exhaust the flue gas from the combustion chamber;

a steam subassembly having a supply water inlet, a heat exchange zone, a water drum, a steam quality actuator and a steam outlet, the supply water inlet constructed and arranged to provide feed water to the heat exchange zone, the heat exchange zone constructed and arranged to transfer at least a portion of the heat generated by combustion of the fuel to the water and generate steam having characteristics including steam temperature and steam pressure, the water drum constructed and arranged to receive the heated water and steam from the heat transfer zone and maintain water and steam in the drum at a selected steam pressure and water level, the steam outlet constructed and arranged to transfer steam from the water drum and transport it out of the steam subassembly, and the steam quality actuator constructed and arranged to regulate at least one characteristic of the steam;

the primary oxidant inlet having a first inlet stream actuator constructed and arranged to regulate the rate of oxygen being introduced into the combustion chamber at the primary inlet;

the secondary oxidant inlet having a second inlet stream actuator constructed and arranged to regulate the rate of oxygen being introduced into the combustion chamber at the secondary inlet;

the fuel inlet having a fuel inlet actuator constructed and arranged to regulate the rate of fuel being introduced into the combustion chamber;

a water drum condition monitor constructed and arranged to monitor the water level and at least one of the temperature and pressure in the water drum and generate water drum data;

a combustion controller having a flue gas data input, a water drum data input, a combustion control output and a steam control output, and being constructed and arranged to

perform control to accommodate shifting process conditions utilizing the flue gas data and the water drum data to generate combustion control output and steam control output;

the flue gas data input receiving the flue gas data, the water drum data input receiving the water drum data, the combustion controller comparing the data and performing the control to accommodate shifting process conditions, thereby selecting the combustion control output and the steam control output; and

the combustion control output operatively associated with the primary inlet stream actuator, the secondary inlet stream actuator, the fuel inlet actuator and the steam quality actuator to optimize combustion of the fuel.

8. The boiler of Claim 7, wherein the flue gas data comprises information regarding flue gas characteristics including at least one of O_2, NO_x, SO_x, H_2O, CO, CO_2 and T_{fg}.

9. The boiler of Claim 7, wherein the flue gas data comprises information regarding flue gas characteristics including at least one characteristic from which at least one of O_2, NO_x, SO_x, H_2O, CO, CO_2 and T_{fg} can be deduced.

10. The boiler of Claim 7, the primary oxidant inlet stream actuator being constructed and arranged to regulate the amount of oxygen flowrate by varying the oxygen content of the oxidant stream.

11. The boiler of Claim 7, the secondary oxidant inlet stream actuator being constructed and arranged to regulate the amount of oxygen flowrate by varying the oxygen content of the oxidant stream.

12. The boiler of Claim 7, the primary oxidant inlet stream actuator being constructed and arranged to regulate the amount of oxygen flowrate by varying the flowrate of oxidant in the oxidant stream.

13. The boiler of Claim 7, the secondary oxidant inlet stream actuator being constructed and arranged to regulate the amount of oxygen flowrate by varying the flowrate of oxidant in the oxidant stream.

14. The boiler of Claim 7, wherein the burner subassembly further comprises a tertiary oxidant inlet constructed and arranged to provide a tertiary oxygen-containing inlet stream to the combustion chamber at a location sufficiently removed from the fuel inlet and the secondary inlet to define a third combustion zone,

the tertiary oxidant inlet having a third inlet stream actuator constructed and arranged to regulate the rate of oxygen being introduced into the combustion chamber at the tertiary inlet;

the combustion control output operatively associated with the tertiary inlet stream actuator to optimize combustion of the fuel.

15. The boiler of Claim 7, wherein the combustion controller is constructed and arranged to perform advanced control to accommodate shifting process conditions utilizing the flue gas data and the water drum data to generate combustion control output and steam control output, the combustion controller comparing the data and performing the advanced control to accommodate shifting process conditions, thereby selecting the combustion control output and the steam control output.

16. The boiler of Claim 15, wherein the combustion controller is constructed and arranged to perform multivariable control to accommodate shifting process conditions utilizing the flue gas data and the water drum data to generate combustion control output and steam control output, the combustion controller comparing the data and performing the multivariable control to accommodate shifting process conditions, thereby selecting the combustion control output and the steam control output.